Project courtesy of Imoto Lines, Ltd. and Kyokuyo Shipyard Corporation

Utilization of OCX as part of 3D Model Based Approval in ship design process

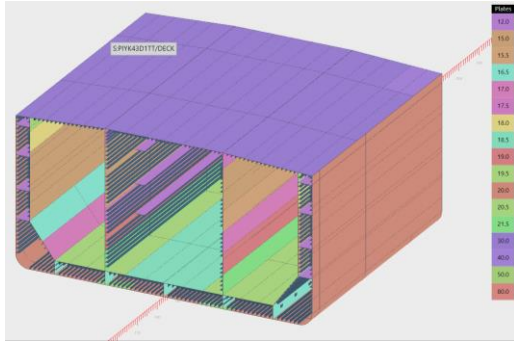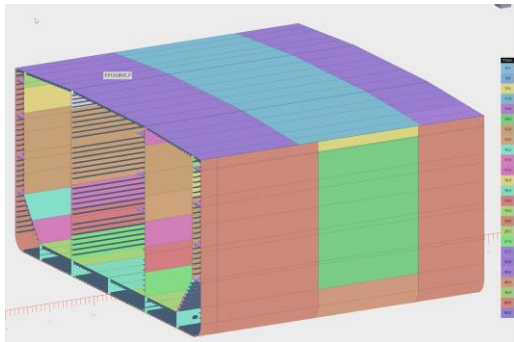Tapio Seppälä
Product Owner, NAPA Steel

napa.fi

Overview

Rule Scantling Iteration in CAD

napa.fi

Conventional rule scantling (2dlx format)

NAPA Designer – Steel 3D model

(Before rule check)

Export cross-sections
(2dlx format)

Export compartments data
(.csv)

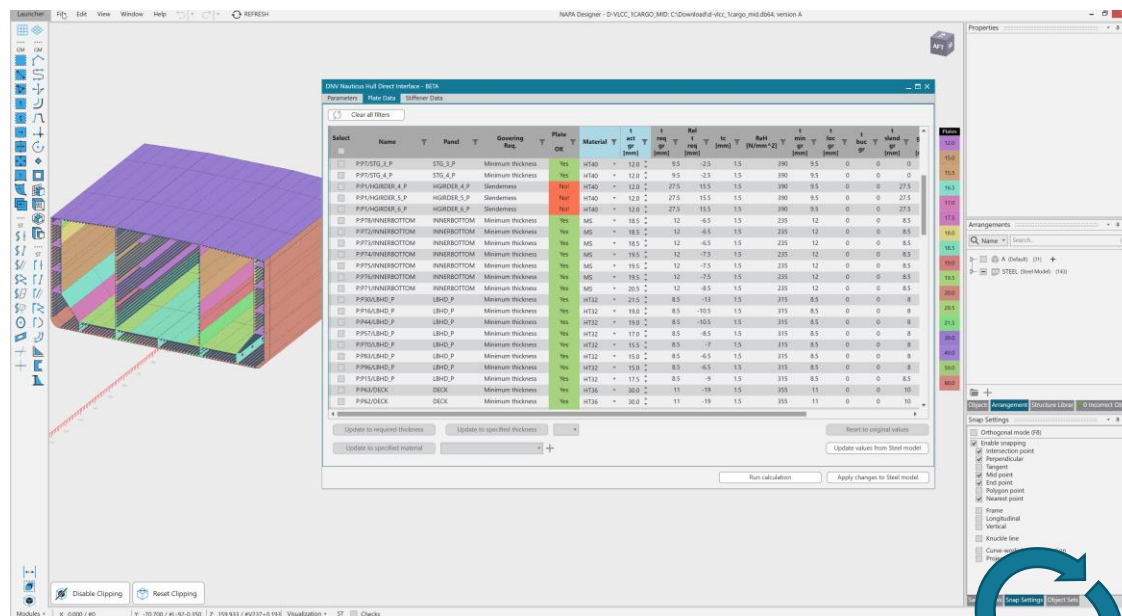Manual update 3D model scantling

Update with 2dlx+Napa Script

NAPA Designer – Steel 3D model

(after rule check)
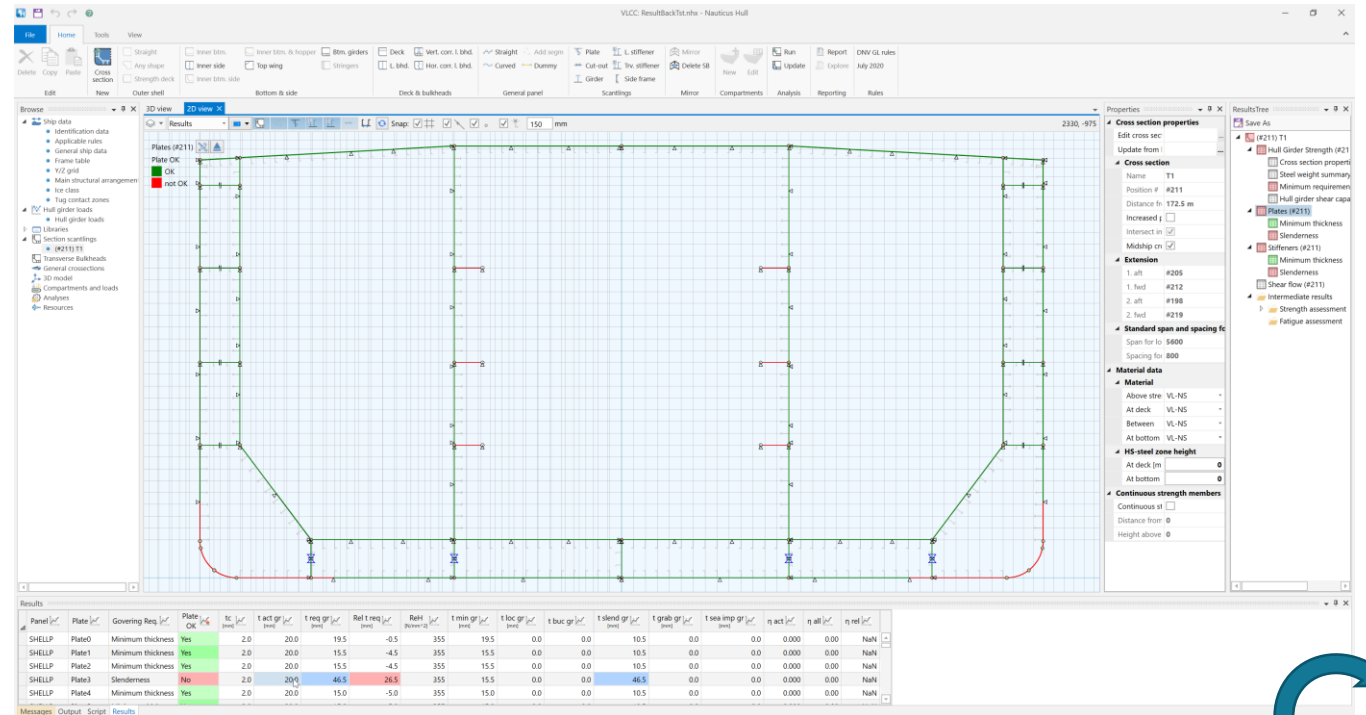
DNV Nauticus Hull – Workspace

(general info, rule, hull girder loads, compartment manual mapping for section)

Scantling Changes+Run

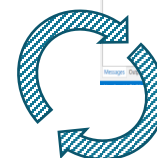# NAPA-DNV Nauticus Hull direct interface
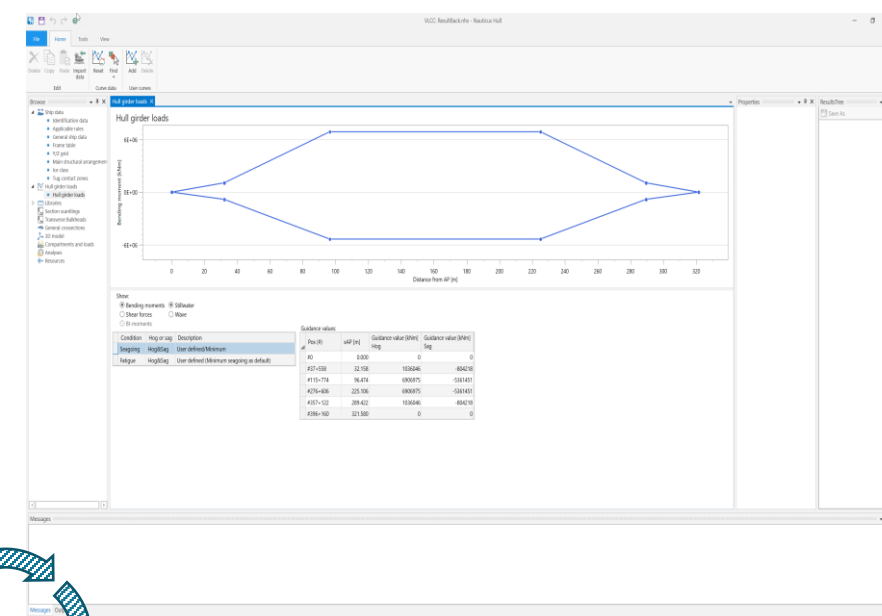

NAPA Designer – Steel 3D model
(rule check + model change/update)

3D Model (OCX) Section and setting(.js)

Result (xml)

DNV Nauticus Hull – Workspace
(general info, rule, hull girder loads, compartments)

Scantling Changes+Run

Background Rule check

✓ Rule calculation in NAPA Designer based on DNV Nauticus Hull
✓ Design iteration of scantling can be possible without leaving NAPA
Designer until it satisfies the rule requirement

File menu (open):

Open / Create Project...	Ctrl+O
Change Project Version	▶
Manage Versions	
Copy Content...	
Import	▶
Export	▶
Direct Interface	▶
Recent Projects	▶
Switch User	
Exit	

DNV Nauticus Hull - BETA

FORE

Properties

Plates

10.0
12.0
15.0
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0
20.5
21.0
21.5
22.0
30.0
40.0
50.0
80.0

Arrangements

Name ▼   Search...

▷ ☐ A (Default) (31) +
▷ ☐ STEEL (Steel Model) (143)

Objects | Arrangement | Structure Librar | 0 Incorrect Object

Snap Settings

☐ Orthogonal mode (F8)

☑ Enable snapping
  ☑ Intersection point
  ☑ Perpendicular
  ☐ Tangent
  ☑ Mid point
  ☑ End point
  ☐ Polygon point
  ☑ Nearest point

  ☐ Frame
  ☐ Longitudinal
  ☐ Vertical

  ☐ Knuckle line

  ☐ Curve-workplane intersection
  ☐ Project snap to workplane

Saved Views | Snap Settings | Object Sets

Disable Clipping   Reset Clipping

Modules ▼   X: 0.000 / #0   Y: -50.913 / #L-65-0.003   Z: 24.762 / #V27+0.222   Visualization ▼   ST ☐ Checks

OCX as ship structural 3D model transfer

- **NAPA Designer: OCX export**
  - ✓ Panels, stiffener, plates, bracket, pillars
  - ✓ Catalogue: material, profiles, hole
  - ✓ Principal particulars and frame systems
  - ✓ Compartments, mapping of purpose
  - ✓ Mapping structure types to OCX function types
  - ✓ End connections of stiffeners
  - ✓ Units
  - ✓ **Update file with the changed properties only**
  - ✓ Export **only limited by clipping box** (Efficiency in data transfer)
  - ✓ GUID synchronization btw OCX in the same project (Revision control)
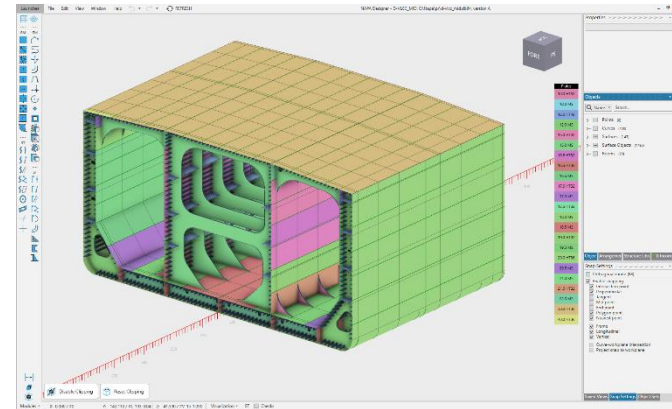
NAPA Designer
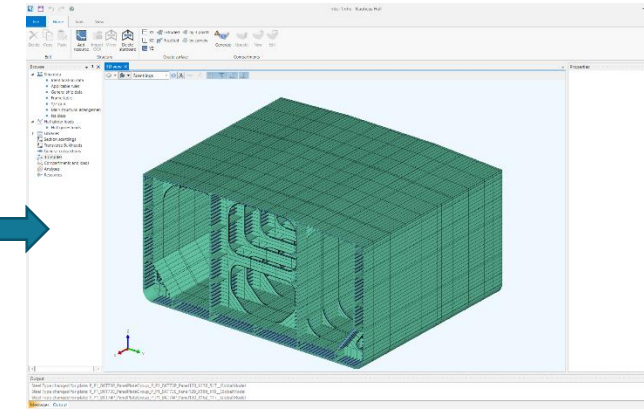
DNV Nauticus Hull

- **DNV Nauticus Hull: OCX import**
  - ✓ Reconstruct 3D structural model
  - ✓ Import all relevant general information
  - ✓ **Capability to create cross-sectional model**
  - ✓ To export local scantling result with original ID in OCX file
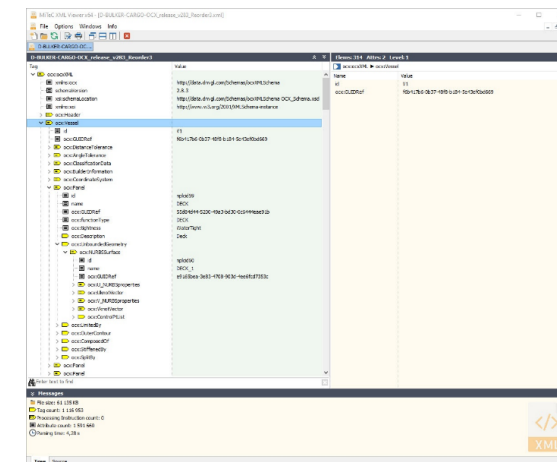
OCX File (3DOCX; Xml)

OCX as ship structural 3D model transfer

# Case study: OCX 3D model transfer possibilities

- Piloting OCX as data transfer format between NAPA Steel and Dassault CATIA V6
    - Performed as part of Sami Gusani's master's thesis and compared against other possible transfer approaches
    - OCX Export from NAPA Steel and Import into CATIA V6 using the import tool for CATIA currently being developed by AITAC
    - Test case: Part of Cruise vessel superstructure deck with below structures

- Initial results show good potential in this approach

- Needs for further development identified
    - Improvements for export and import interfaces
    - Some enhancements to OCX schema would be needed
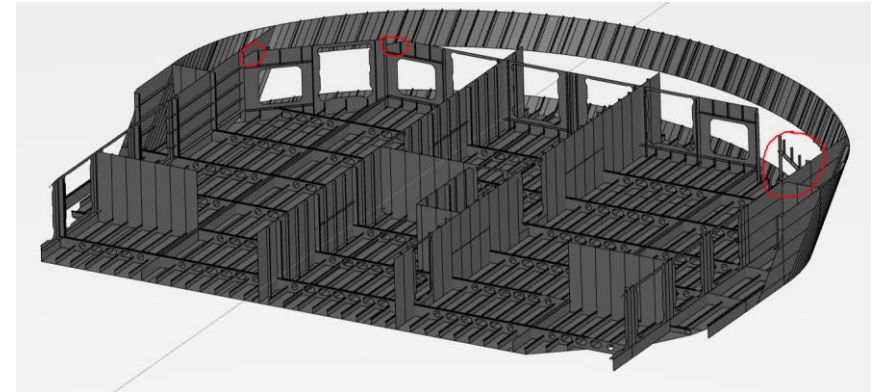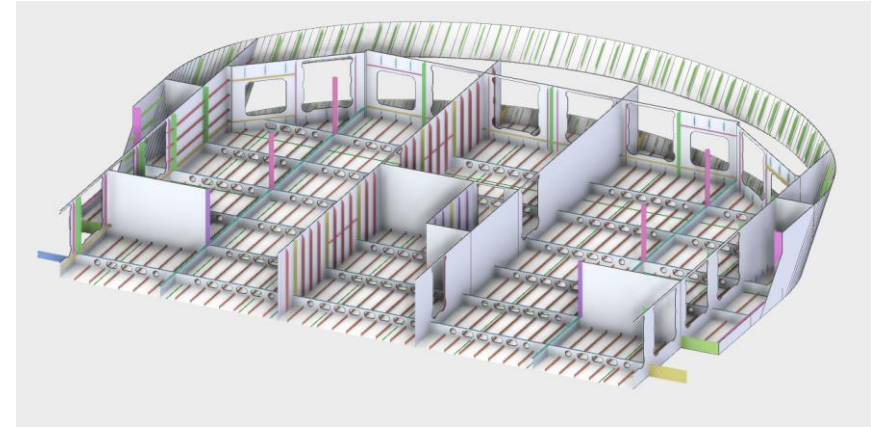
Project courtesy of Meyer Group
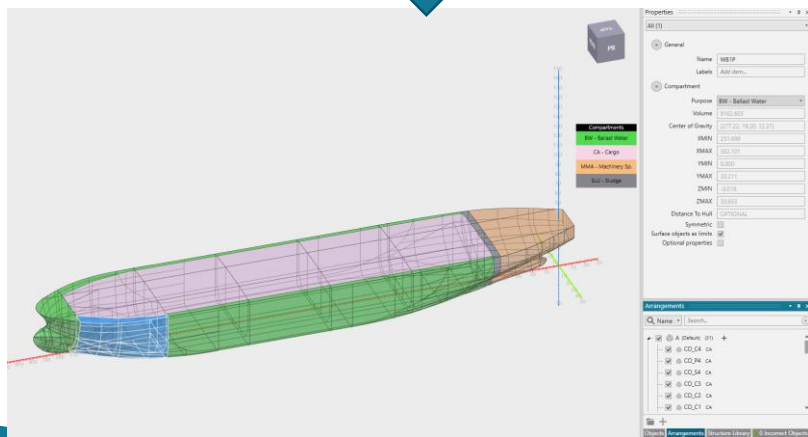
OCX Import / Further Utilizations for 3D MBA
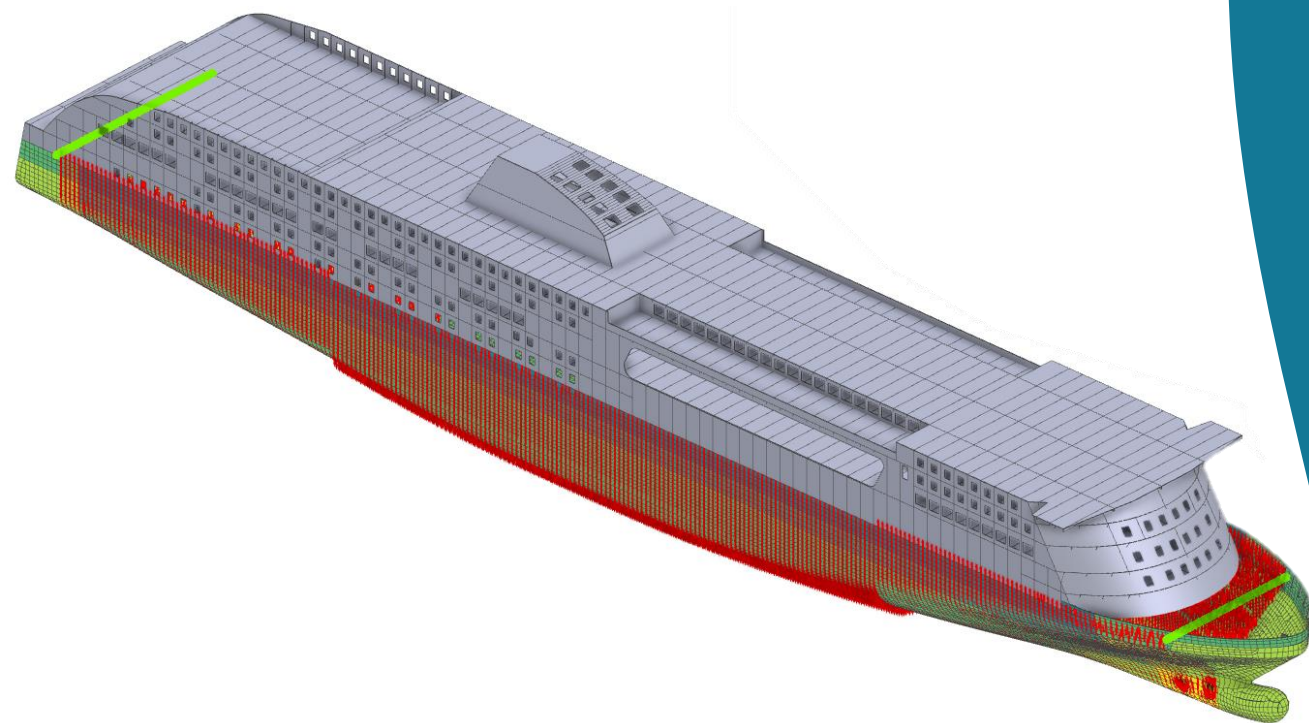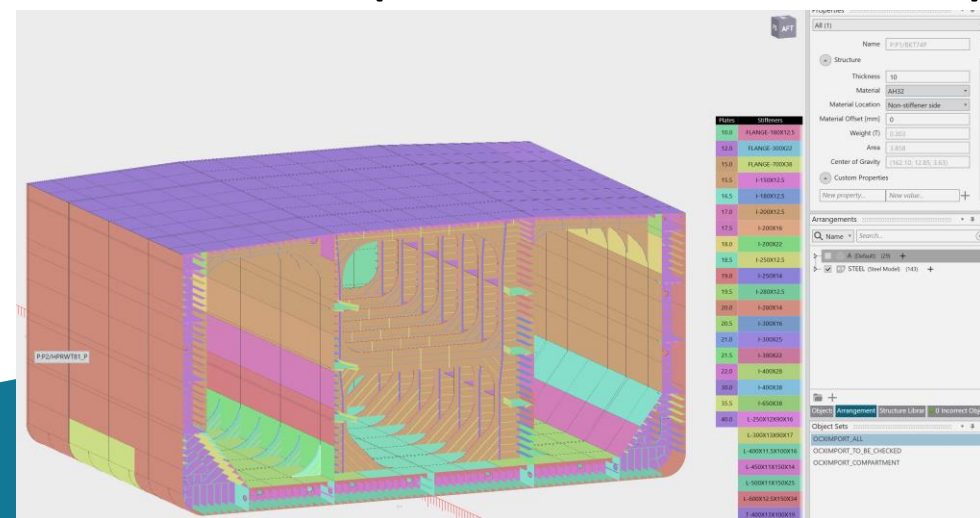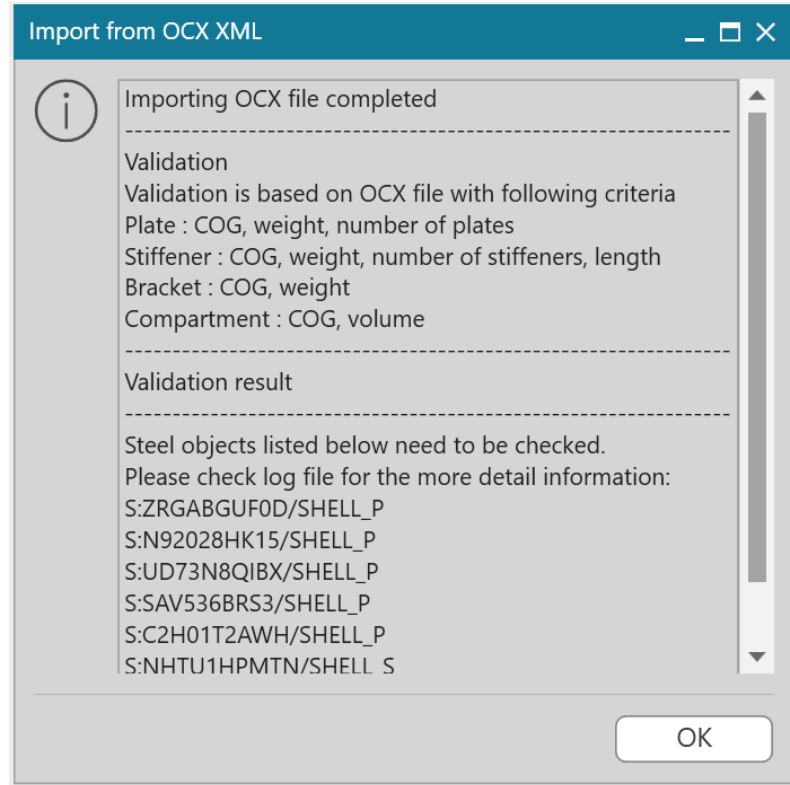
OCX Import to NAPA Designer
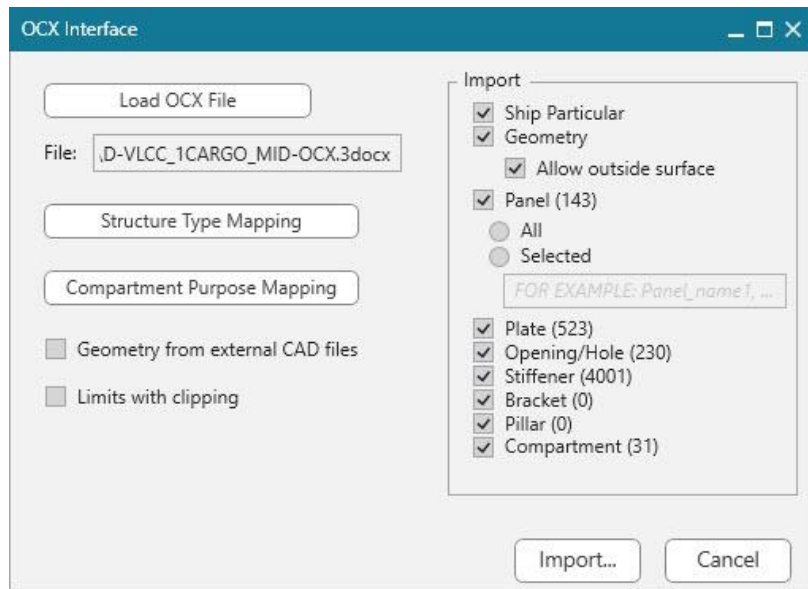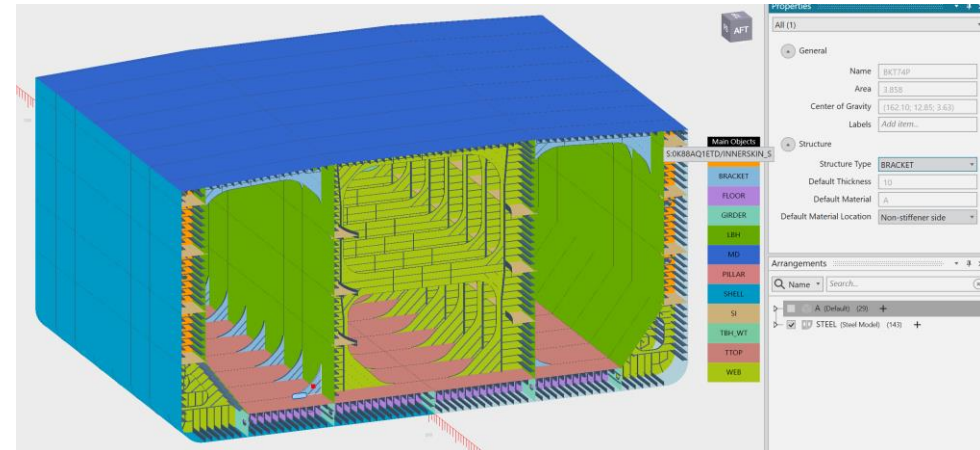
Main Objects

Structural Parts (Plates, Stiffeners, Brackets)

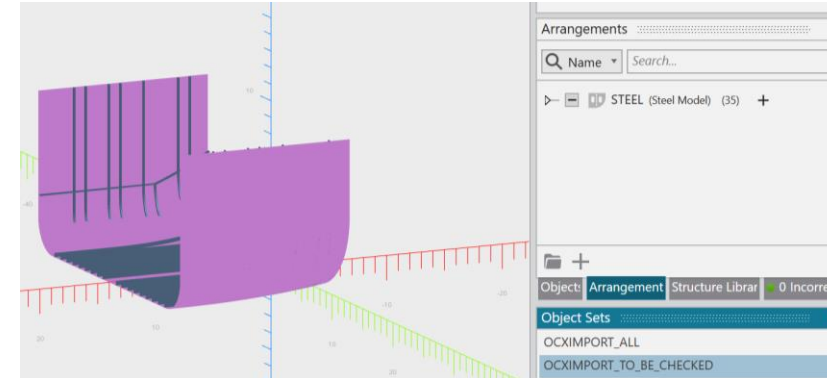**Compartments**

OCX Imported model validation

Import validation summary

Object Set

Import log

- Before import: schema version, critical errors
- On importing: geometry error, data errors or missing data
- After import: OCX model validation check

OCX Model further utilizations in NAPA Designer
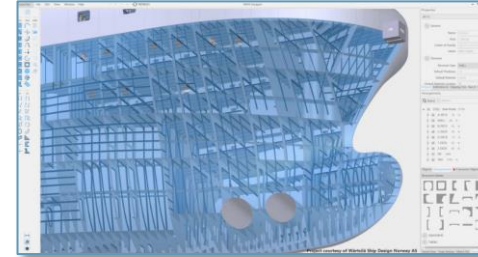
- **Modeling Changes**
- **Structural drawings**
- **Interfaces to other CAD systems**
- **Interfaces to Class Society rules**
- **FEM meshing**
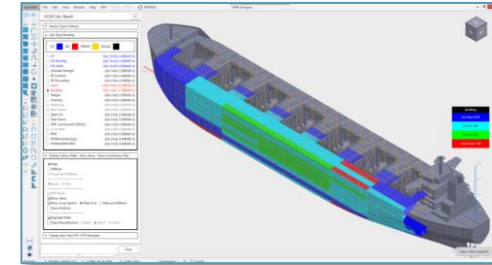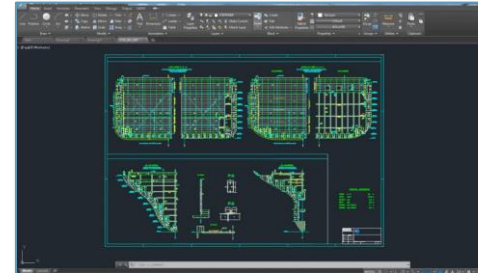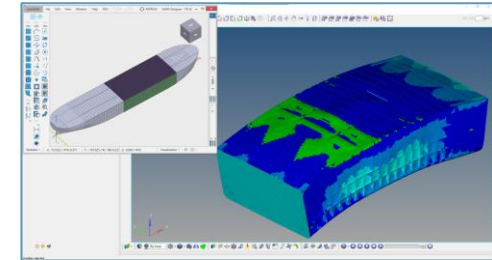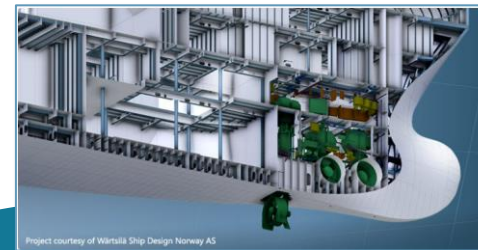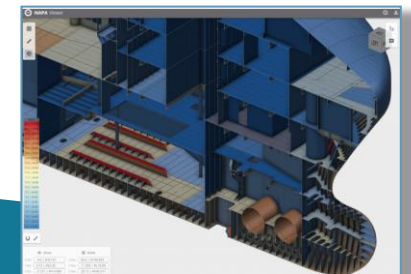- **Web viewer**

MODELING CHANGE

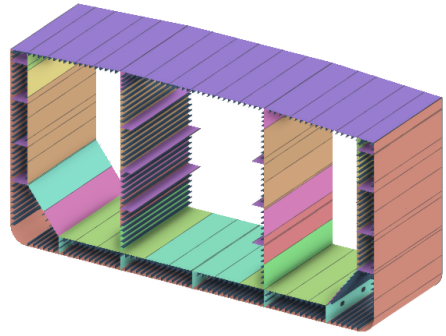
RULE INTERFACES
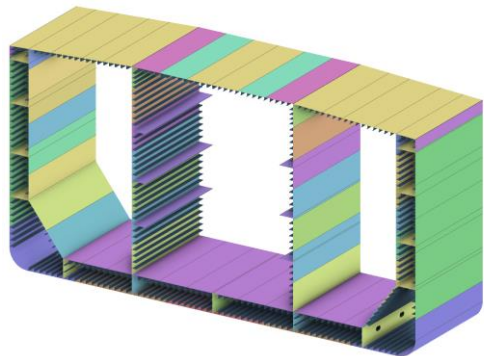

DRAWINGS

FEM

CAD INTERFACES

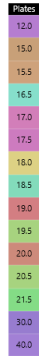WEB VIEWER

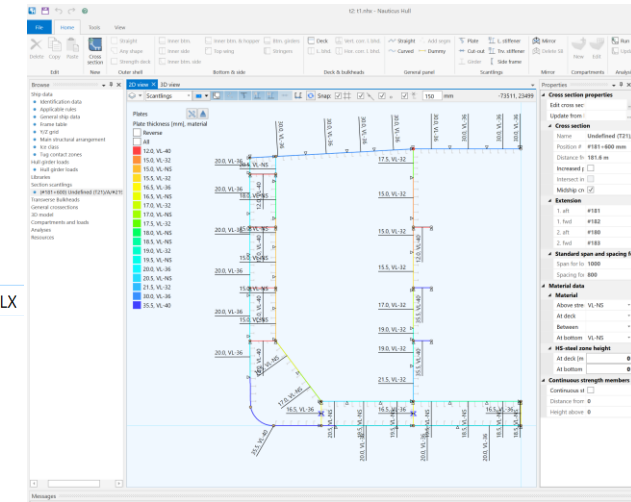# Rule scantling

Initial scantling
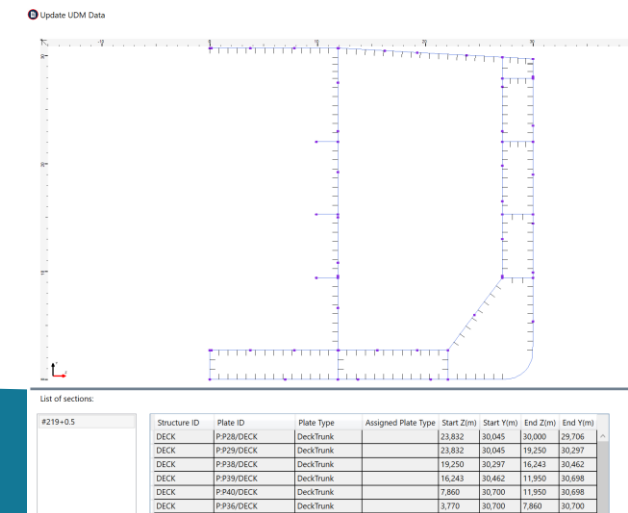
Rule scantling
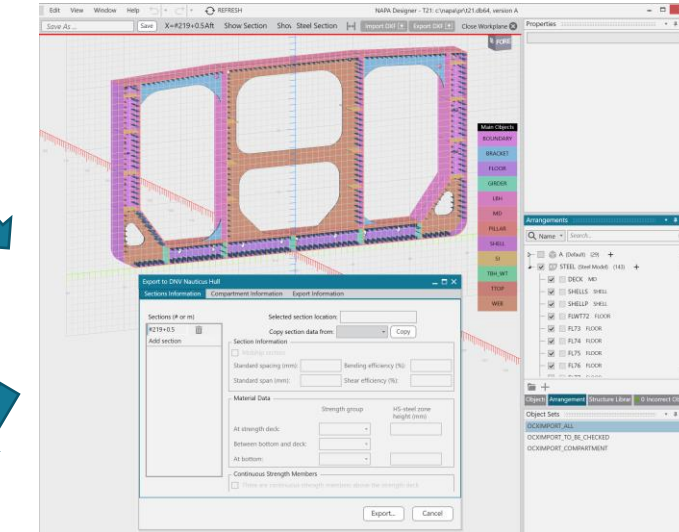
**OCX-imported model
Exported to…**

Rule Check Interfaces

(T21)_#219+0.5_HALF.2DLX
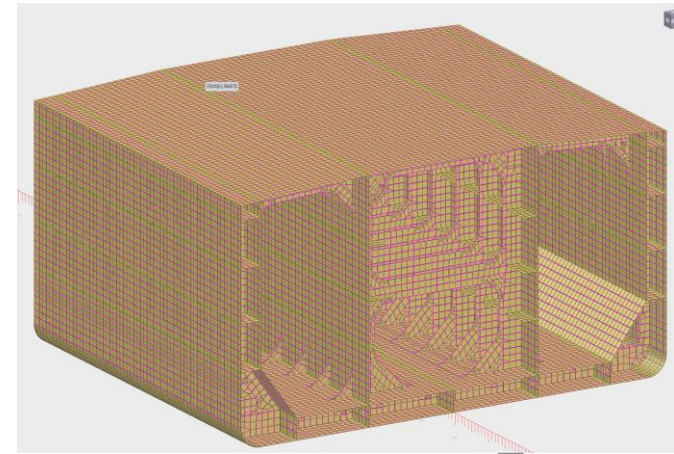
DNV Nauticus Hull

T21-ABS.xml

ABS Eagle UDM

FEM with OCX imported model

FE model creation from **OCX** model

Load   Constraints
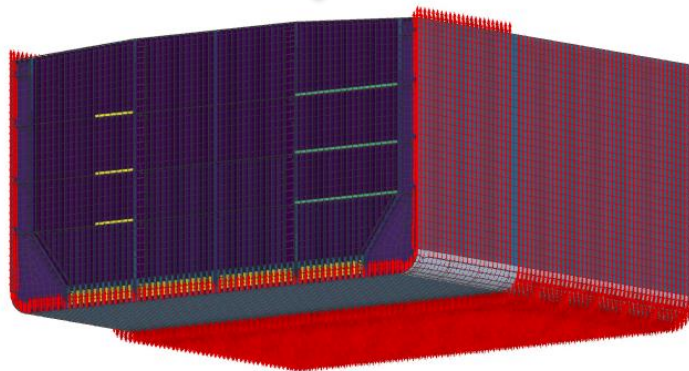
Opening/Bracket toes with real geometries
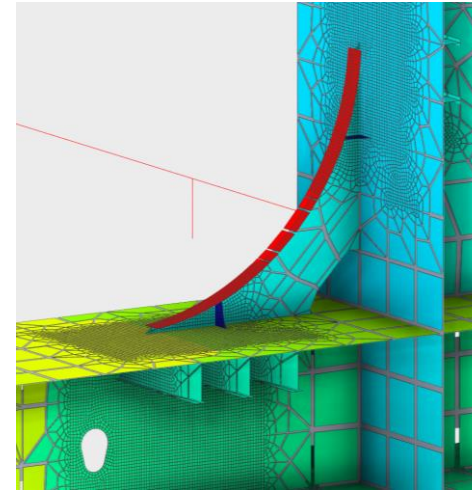
OCX compartment

Fine-Mesh model for local analysis
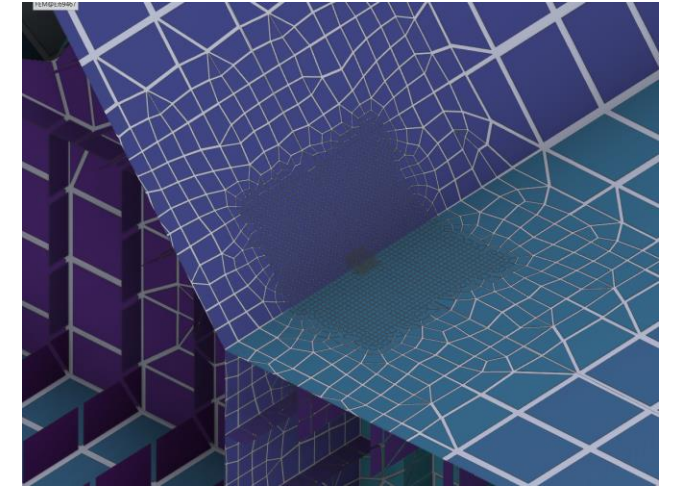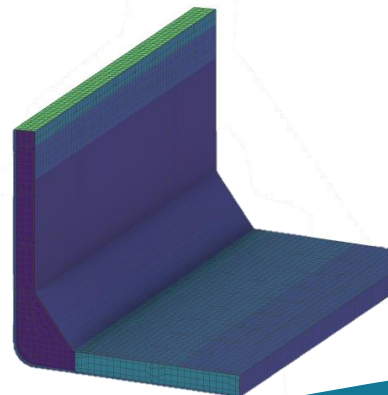
FEM **Compartment grouping**

FEA **Solvable** model

2D Drawing generation
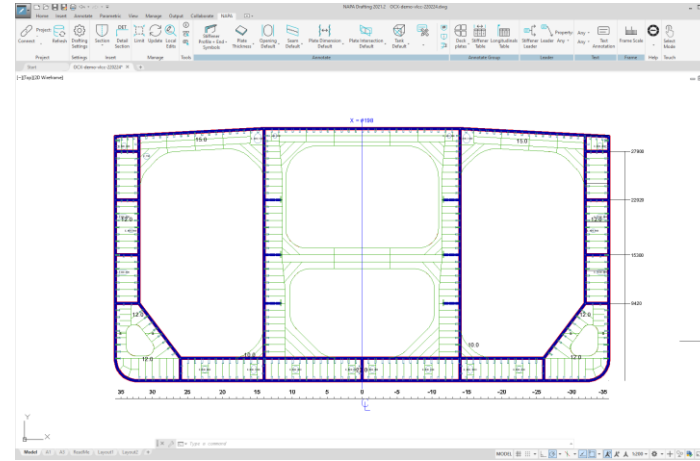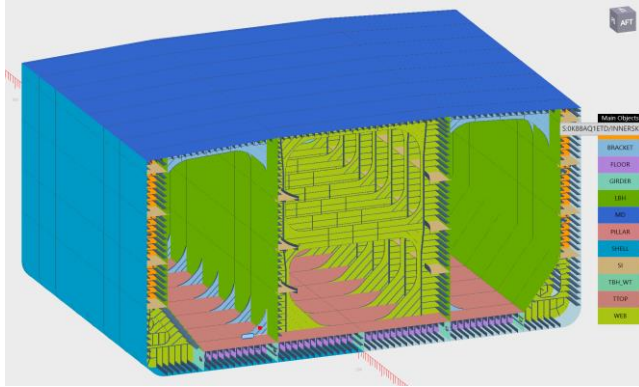
✓ 2D drawing is still required as output, archive

✓ OCX imported structure model can be accessed in

NAPA Drafting

 - 2D Drafting based on AutoCAD

 - Information extraction as annotation and update

geometry based on 3D model on 2D drawing by NAPA

Project courtesy of Wärtsilä Ship Design Norway AS

3D model review and information sharing
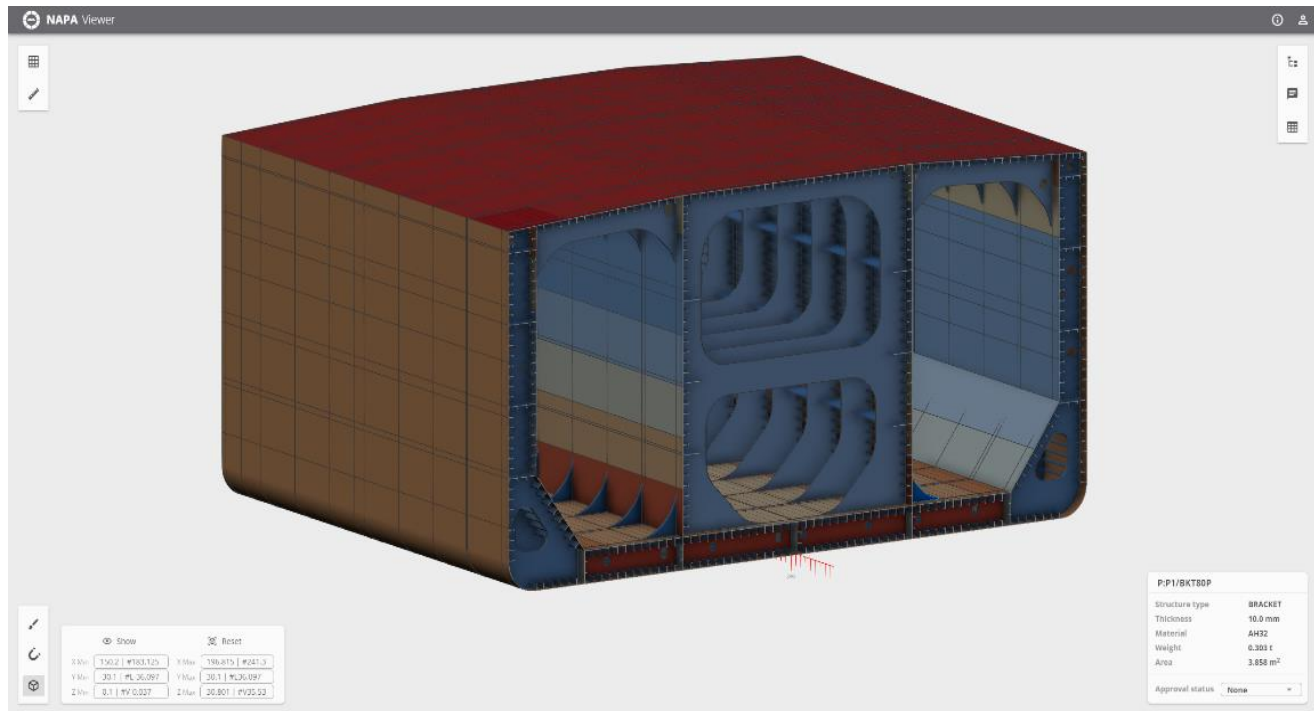
- ✓ NAPA Viewer: Web viewer

- ✓ Essential data sharing for 3D MBA

- ✓ Access restriction on geometry
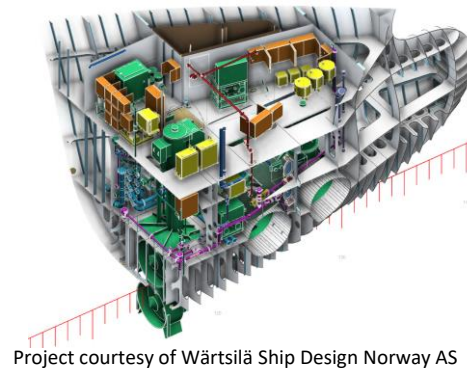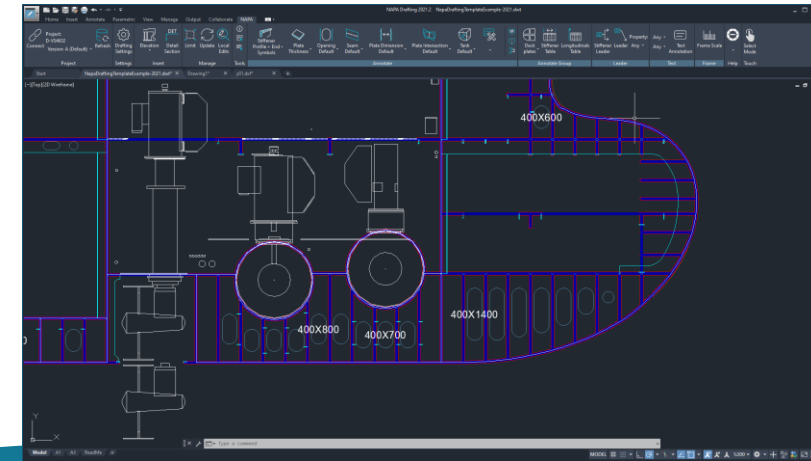 (physical file is not shared with)

- ✓ User-specific commenting, with integration to
  NAPA Designer and in future DNV solutions

- ✓ Cross-section view represented in 2D drawing
  including annotations

- ✓ Both of structure and compartment
  model available

3D model translator

To CAD formats
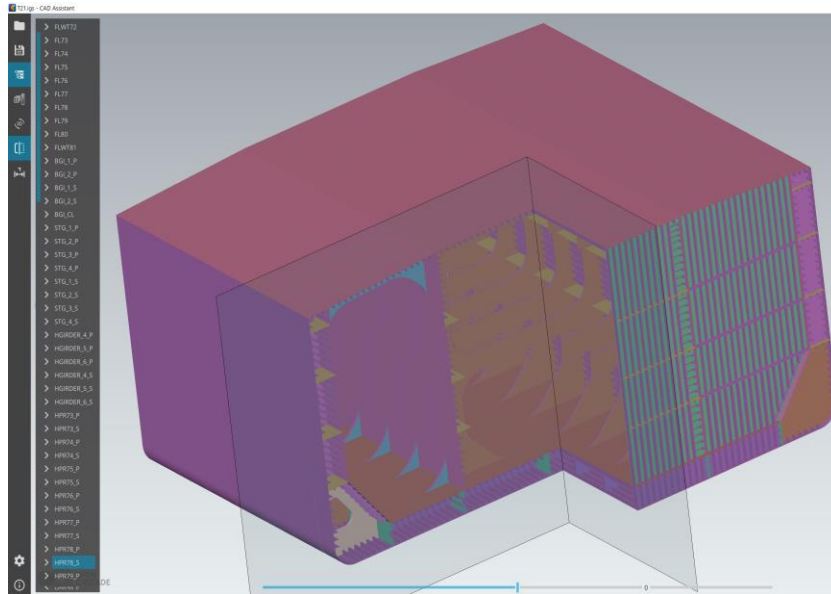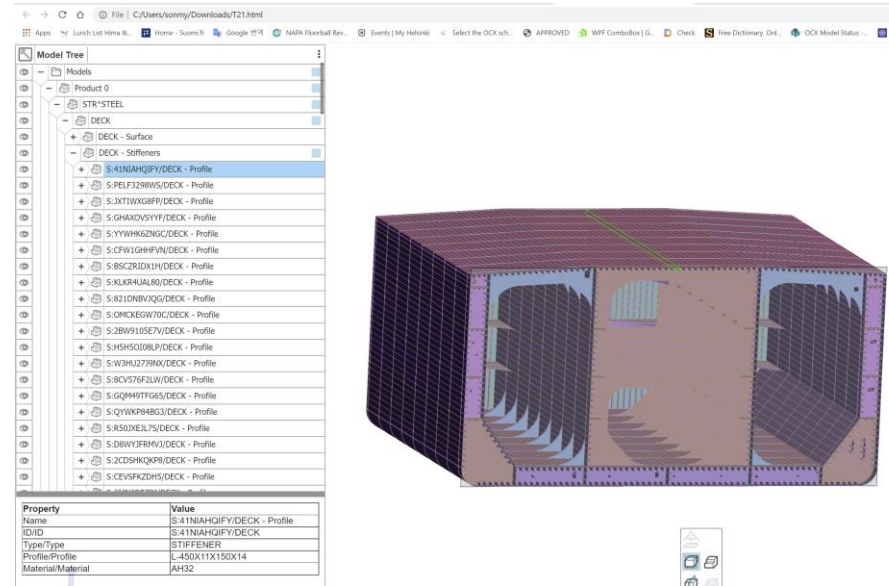
To publish formats

To downstream shipbuilding CAD:

Production Design interfaces

- ACIS SAT, FBX, IGES, JT, Parasolid (x_t) PRC, STEP, STL, U3D, VRML, OBJ, 3MF

- 3DPDF, HTML

Conclusion

- OCX as **standard format for 3D MBA**

- OCX interface offers benefits by **reusing 3D model**
  - ✓ Rule scantling interface
  - ✓ Rule scantling iteration in design tool

- OCX import, for **further utilizations for 3D MBA**
  - ✓ Rule scantling
  - ✓ FEM
  - ✓ 2D drawings
  - ✓ 3D model review and Information sharing
  - ✓ Model translator

- Future works:
  - ✓ **Commenting interface** between NAPA, DNV
  - ✓ OCX extension : FE loads & constraints, optional design data for file transfer needs

Thank You!

Tapio Seppälä

Product Owner, NAPA Steel

Tapio.seppala@napa.fi